Uttara University

COURS CODE: CSEC428

COURSE NAME:

Computer Graphics

Assignment

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BATCH : 57

SECTION : A

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Answere to the question no. 1:

(a)

In Cyrus-Beck algorithm, the fundamental fore corelation is, the segment is visible only if $t_E \le t_L$.
If $t_E > t_L$, it means the line enters after it leaves, which is not possible. Hence, no visible segment inside the window.

Evaluation:

1. Tenz

$\Rightarrow t_E = 0.74$, $t_L = 1.06$

Here $T_E < t_L$

$\therefore$ The result is valid and the line segment is partially visible betwee $t = 0.74$ and $t = 1.06$, though the portion from 1.0 to 1.06 lies beyond the boundary.

2. Nivera:

$t_E = 0.38$, $t_L = 0.27$

Here $t_E > t_L$, this violates the Cyrus-Beck condition.

So the result is invalid as there is no visible portion and line segment is outside the clipping window.

3. Jampi:

Here $t_E = 0.69$, $t_L = 0.81$

$\therefore t_E < t_L$

The result is valid with a visible segment from $t = 0.69$ to $t = 0.81$

$\therefore$ Jampi used the Cyrus-Beck algorithm correctly, because the result satisfies the condition $t_E < t_L$ and both values lie within the typical parameter range $[0,1]$ making the line segment visible inside the clipping window.

(b)

$P_0 = (10, 60)$, $P_1 = (25, 30)$

$P_1 - P_0 = (x_1 - x_0, y_1 - y_0)$

$= (25-10, 30-60)$

$= (15, -30)$

Parametric equation:

$P(t) = P_0 + t(P_1 - P_0)$

$= (10, 60) + t(15, -30)$

$= (10+15t, 60-30t)$

At, $t = \frac{3}{5}$,

$P(\frac{3}{5}) = (10+15(\frac{3}{5}), 60-30(\frac{3}{5})) = (19, 42)$

(c)

Clipping region: $(-30,15)$ and $(20,25)$

$x_{min} = -30$, $x_{max} = 20$

$y_{min} = 15$, $y_{max} = 25$

$P1(10,18)$ and $P2(-45,20)$

$\therefore x_1 = 10$ $\quad x_2 = -45$

$y_1 = 18$ $\quad y_2 = 20$

Outcode for P1:

$x_1 \geq x_{min} \Rightarrow 10 \geq -30 \Rightarrow$ True ; Left $= 0$

$x_1 \leq x_{max} \Rightarrow 10 \leq 20 \Rightarrow$ True ; Right $= 0$

$y_1 \geq y_{min} \Rightarrow 18 \geq 15 \Rightarrow$ True ; Bottom $= 0$

$y_1 \leq y_{max} \Rightarrow 18 \leq 25 \Rightarrow$ True ; Top $= 0$

Outcode, P1 = 0000

Outcode for P2:

$x_2 \geq x_{min} \Rightarrow -45 \geq -30 \Rightarrow$ False ; Left $= 1$

$x_2 \leq x_{max} \Rightarrow -45 \leq 20 \Rightarrow$ True ; Right $= 0$

$y_2 \geq y_{min} \Rightarrow 20 \geq 15 \Rightarrow$ True ; Bottom $= 0$

$y_2 \leq y_{max} \Rightarrow 20 \leq 25 \Rightarrow$ True ; Top $= 0$

Outcode, P2 = 0001

OCP1 AND OCP2

$$\begin{array}{r} 0000 \\ 0001 \\ \hline 0000 \end{array}$$

The line is partially inside of the clipping region.

OCP2 = 0001

OCP2 != 0000 and has a left bit.

Applying left boundary intersection:

P2 (−45, 20) Here $x_1 = -45$, $y_1 = 20$

$x_2 = x_{min} = -30$

$y_2 = y_2 + m(x_{min} - x_2)$

$m = \frac{20-18}{-45-10} = -\frac{2}{55}$

$y_2 = 20 - \frac{2}{55}(-30+45)$

$y_2 = 20 - \frac{2}{55}(15)$

$y_2 = 19.45$

New, P2 = (−30, 19.45);

Outcode P2 (−30, 19.45):

$-30 \geq -30 \Rightarrow$ True ; Left = 0

$-30 \leq 20 \Rightarrow$ True ; Right = 0

$19.45 \geq 15 \Rightarrow$ True ; Bottom = 0

$19.45 \leq 25 \Rightarrow$ True ; Top = 0

∴ OCP2 = 0000

OCP1 = 0000

Since OCP1 == OCP2 == 0000, the line is now completely inside the window and the points are P1(10, 18) and P2(−30, 19.45)

Answer to the question no. 2:

(a)

60 degrees clockwise rotation with respect to the point (6,6)

Composite matrix, $M = T_{(6,6)} \times R_{(-60)} \times T_{(-6,-6)}$

$$= \begin{bmatrix} 1 & 0 & 6 \\ 0 & 1 & 6 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(-60) & -\sin(-60) & 0 \\ \sin(-60) & \cos(-60) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -6 \\ 0 & 1 & -6 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 6 \\ 0 & 1 & 6 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.5 & 0.866 & 0 \\ -0.866 & 0.5 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -6 \\ 0 & 1 & -6 \\ 0 & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 6 \\ 0 & 1 & 6 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.5 & 0.866 & -8.196 \\ -0.866 & 0.5 & 2.196 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.5 & 0.866 & 3.804 \\ -0.866 & 0.5 & 14.196 \\ 0 & 0 & 1 \end{bmatrix}$$

(b)

Line $\Rightarrow y = \sqrt{3}x + 3$

$b = 3$, $m = \sqrt{3}$, $\theta = \tan^{-1}\sqrt{3} = 60$

$M_{composite} = T(0,3) \times R(60) \times Reflect(x\text{-}axis) \times R(60) \times T(0,-3)$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 60 & -\sin 60 & 0 \\ \sin 60 & \cos 60 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(-60) & -\sin(-60) & 0 \\ \sin(-60) & \cos(-60) & 0 \\ 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -3 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 60 & -\sin 60 & 0 \\ \sin 60 & \cos 60 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.5 & 0.866 & -2.598 \\ -0.866 & 0.5 & -1.5 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 60 & -\sin 60 & 0 \\ \sin 60 & \cos 60 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.5 & 0.866 & -2.598 \\ 0.866 & -0.5 & 1.5 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -0.5 & 0.866 & -2.598 \\ 0.866 & 0.5 & -1.5 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -0.5 & 0.866 & -2.598 \\ 0.866 & 0.5 & 1.5 \\ 0 & 0 & 1 \end{bmatrix}$$

point (5,6)

$$P' = M_{composite} \times P$$

$$= \begin{bmatrix} -0.5 & 0.866 & -2.598 \\ 0.866 & 0.5 & 7.5 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 5 \\ 6 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.098 \\ 8.830 \\ 1 \end{bmatrix}$$